

Section 8. Nuclear Energy

U.S. nuclear electricity net generation during December 2002 was forecast as 62 net terawatthours (billion kilowatthours) of electricity, 9 percent lower than in December 2001. Nuclear units generated at an average capacity factor of 84.3 percent, 8.0 percentage points lower than the capacity factor in December 2001.

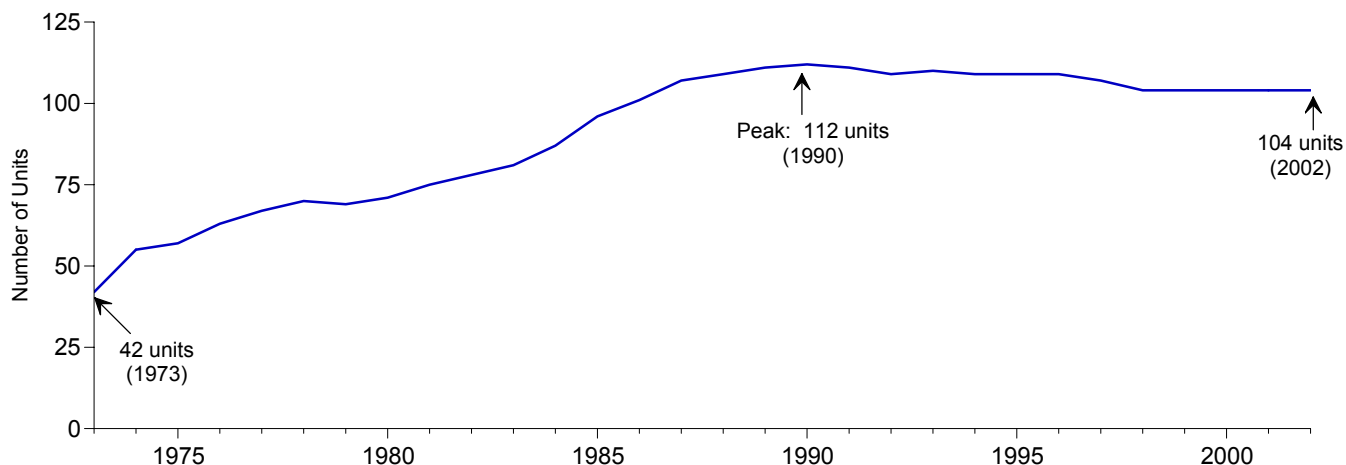
On December 31, 2002, there were 104 operable nuclear generating units in the United States, with a collective net summer capability of 98.2 million kilowatts of electricity.

Of the 104 operable units, 1 unit generated no electricity during the month because of maintenance, refueling, or repair outage, and 86 units reported operating at 90 percent of capacity or more. Of these 86 units, 54 operated at 100 percent or greater (based on net summer capability).

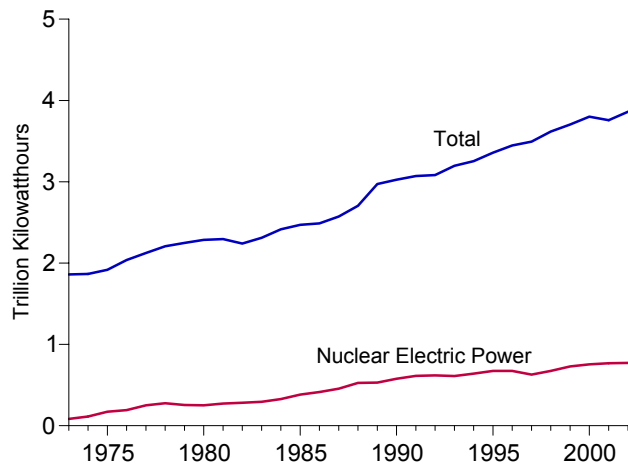
In addition, there were three other units with construction permits, but construction for all three units has been halted. Their combined design capacity is 3.6 million kilowatts.

Figure 8.1 Nuclear Power Plant Operations

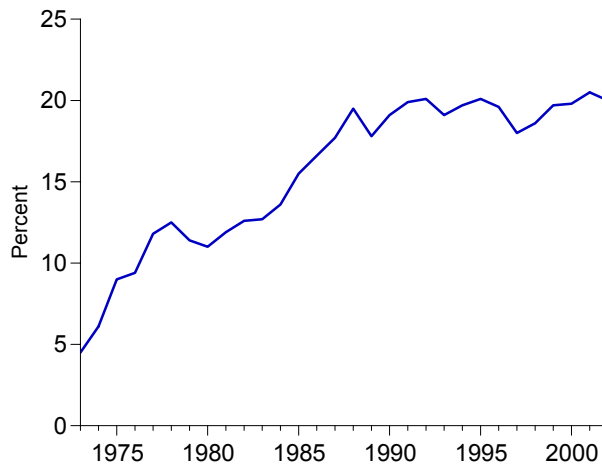
Operable Units, End of Year, 1973-2002



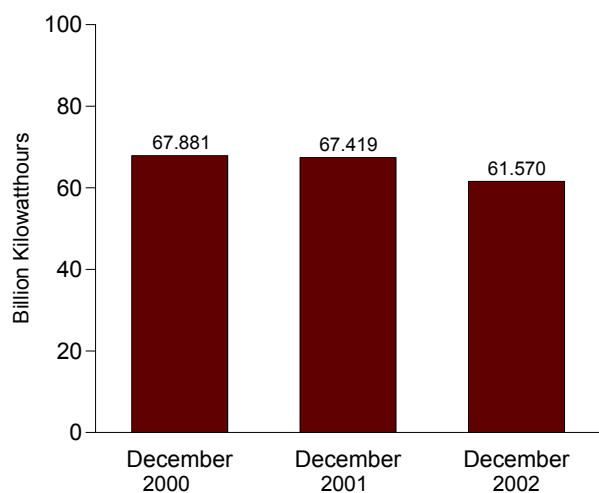
Electricity Net Generation, 1973-2002



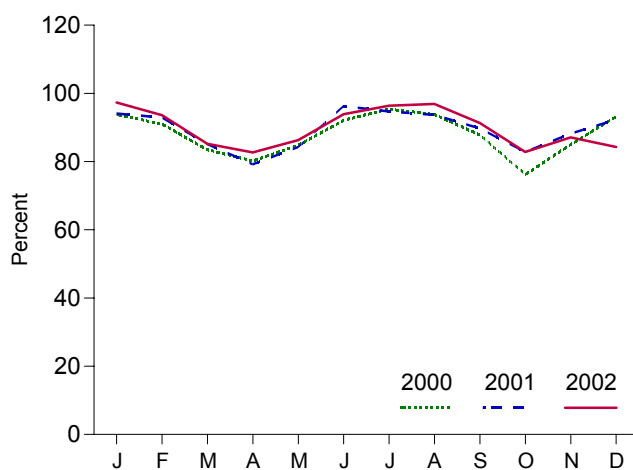
Nuclear Share of Electricity Net Generation, 1973-2002



Nuclear Electricity Net Generation



Capacity Factor, Monthly



Notes: • Includes all units that contributed power to the commercial grid whether they were owned by an electric utility or a nonutility power plant. See Note 1 at end of section for additional information. • Because

vertical scales differ, graphs should not be compared. <http://www.eia.doe.gov/emeu/mer/nuclear.html>. Sources: Table 7.1, 8.1, and 8.2.

Table 8.1 Nuclear Power Plant Operations

	Nuclear Electricity Net Generation	Nuclear Share of Electricity Net Generation	Net Summer Capability of Operable Units ^{a,b}	Capacity Factor ^c
	Million Kilowatthours	Percent	Million Kilowatts	Percent
1973 Year	83,479	4.5	22.683	53.5
1974 Year	113,976	6.1	31.867	47.8
1975 Year	172,505	9.0	37.267	55.9
1976 Year	191,104	9.4	43.822	54.7
1977 Year	250,883	11.8	46.303	63.3
1978 Year	276,403	12.5	50.824	64.5
1979 Year	255,155	11.4	49.747	58.4
1980 Year	251,116	11.0	51.810	56.3
1981 Year	272,674	11.9	56.042	58.2
1982 Year	282,773	12.6	60.035	56.6
1983 Year	293,677	12.7	63.009	54.4
1984 Year	327,634	13.6	69.652	56.3
1985 Year	383,691	15.5	79.397	58.0
1986 Year	414,038	16.6	85.241	56.9
1987 Year	455,270	17.7	93.583	57.4
1988 Year	526,973	19.5	94.695	63.5
1989 Year	^d 529,402	^d 17.8	^d 98.179	^d 62.2
1990 Year	576,974	19.1	99.642	66.0
1991 Year	612,642	19.9	99.608	70.2
1992 Year	618,841	20.1	99.004	70.9
1993 Year	610,367	19.1	99.060	70.5
1994 Year	640,492	19.7	99.148	73.8
1995 Year	673,402	20.1	99.515	77.4
1996 Year	674,729	19.6	100.784	76.2
1997 Year	628,644	18.0	99.716	71.1
1998 Year	673,702	18.6	97.070	78.2
1999 Year	728,254	19.7	97.411	85.3
2000 January	68,013	21.0	97.411	93.8
February	61,688	21.3	97.411	91.0
March	60,494	20.5	97.411	83.5
April	56,252	20.2	97.411	80.2
May	61,479	19.7	97.411	84.8
June	64,595	19.5	97.411	92.1
July	69,171	19.6	97.411	95.4
August	67,954	18.5	97.411	93.8
September	61,549	19.3	97.411	87.8
October	55,240	18.5	97.411	76.2
November	59,579	20.0	97.411	85.0
December	67,881	20.2	97.860	93.2
Year	753,893	19.8	97.860	88.1
2001 January	68,705	20.5	98.142	94.1
February	61,270	21.4	98.142	92.9
March	62,140	20.5	98.142	85.1
April	55,992	19.9	98.142	79.2
May	61,528	20.2	98.142	84.3
June	68,022	20.6	98.142	96.3
July	69,163	19.2	98.142	94.7
August	68,386	18.4	98.142	93.7
September	63,381	20.6	98.142	89.7
October	60,484	20.5	98.142	82.8
November	62,338	22.4	98.142	88.2
December	67,419	22.2	^R 98.159	92.3
Year	768,826	20.5	^R 98.159	89.4
2002 January	71,057	22.3	^R 98.159	97.3
February	61,738	22.1	^R 98.159	93.6
March	62,227	20.6	^R 98.159	85.2
April	58,437	20.1	^R 98.159	82.7
May	63,032	20.5	^R 98.159	86.3
June	66,372	19.6	^R 98.159	93.9
July	70,421	18.5	^R 98.159	96.4
August	70,778	19.3	^R 98.159	96.9
September	64,481	19.5	^R 98.159	91.3
October	60,493	19.7	^R 98.159	^R 82.8
November	^R 61,520	^R 20.7	^R 98.159	^R 87.1
December	^F 61,570	^F 17.9	98.159	84.3
Year	^E 772,125	^E 20.0	98.159	^R 89.8

^a At end of period.

^b For the definition of "Net Summer Capability," see Note 2(a) at end of section.

^c For an explanation of the method of calculating the capacity factor, see Note 2 at end of section.

^d Beginning in 1989, includes nonutility facilities.

R=Revised. E=Estimate. F=Forecast.

Notes: • The performance data shown in this table are based on a universe of reactor units that differs in some respects from the reactor

universe used to profile the nuclear power industry in Table 8.2. See Note 1 at end of section for further discussion. • Nuclear electricity net generation totals may not equal sum of components due to independent rounding. • Geographic coverage is the 50 States and the District of Columbia.

Web Page: <http://www.eia.doe.gov/emeu/mer/nuclear.html>.

Sources: See end of section.

Table 8.2 Nuclear Generating Units

	Orders ^a	Construction Permits ^b	Low Power Operating Licenses ^c	New Operable Units ^d	Shutdowns ^e	Total Operable Units ^f	Cancellations ^g	Cumulative Cancellations
1973 Year	42	14	12	15	0	42	0	7
1974 Year	28	23	14	15	2	55	9	16
1975 Year	4	9	3	2	0	57	13	29
1976 Year	3	9	7	7	1	63	1	30
1977 Year	4	15	4	4	0	67	10	40
1978 Year	2	13	3	4	1	70	13	53
1979 Year	0	2	0	0	1	69	6	59
1980 Year	0	0	5	2	0	71	15	74
1981 Year	0	0	3	4	0	75	9	83
1982 Year	0	0	6	4	1	78	18	101
1983 Year	0	0	3	3	0	81	6	107
1984 Year	0	0	7	6	0	87	6	113
1985 Year	0	0	7	9	0	96	2	115
1986 Year	0	0	7	5	0	101 ^h	2	117
1987 Year	0	0	6	8	2	107	0	117
1988 Year	0	0	1	2	0	109	3	120
1989 Year	0	0	3	4	2	111	0	120
1990 Year	0	0	1	2	1	112	1	121
1991 Year	0	0	0	0	1	111	0	121
1992 Year	0	0	0	0	2	109	0	121
1993 Year	0	0	1	1	0	110	0	121
1994 Year	0	0	0	0	1	109	1	122
1995 Year	0	0	1	0	0	109	2	124
1996 Year	0	0	0	1	1	109	0	124
1997 Year	0	0	0	0	2	107	0	124
1998 Year	0	0	0	0	3	104	0	124
1999 Year	0	0	0	0	0	104	0	124
2000 January	0	0	0	0	0	104	0	124
February	0	0	0	0	0	104	0	124
March	0	0	0	0	0	104	0	124
April	0	0	0	0	0	104	0	124
May	0	0	0	0	0	104	0	124
June	0	0	0	0	0	104	0	124
July	0	0	0	0	0	104	0	124
August	0	0	0	0	0	104	0	124
September	0	0	0	0	0	104	0	124
October	0	0	0	0	0	104	0	124
November	0	0	0	0	0	104	0	124
December	0	0	0	0	0	104	0	124
Year	0	0	0	0	0	104	0	124
2001 January	0	0	0	0	0	104	0	124
February	0	0	0	0	0	104	0	124
March	0	0	0	0	0	104	0	124
April	0	0	0	0	0	104	0	124
May	0	0	0	0	0	104	0	124
June	0	0	0	0	0	104	0	124
July	0	0	0	0	0	104	0	124
August	0	0	0	0	0	104	0	124
September	0	0	0	0	0	104	0	124
October	0	0	0	0	0	104	0	124
November	0	0	0	0	0	104	0	124
December	0	0	0	0	0	104	0	124
Year	0	0	0	0	0	104	0	124
2002 January	0	0	0	0	0	104	0	124
February	0	0	0	0	0	104	0	124
March	0	0	0	0	0	104	0	124
April	0	0	0	0	0	104	0	124
May	0	0	0	0	0	104	0	124
June	0	0	0	0	0	104	0	124
July	0	0	0	0	0	104	0	124
August	0	0	0	0	0	104	0	124
September	0	0	0	0	0	104	0	124
October	0	0	0	0	0	104	0	124
November	0	0	0	0	0	104	0	124
December	0	0	0	0	0	104	0	124
Year	0	0	0	0	0	104	0	124

^a Placement of an order by a utility or government agency for a nuclear steam supply system.

^b Issuance by regulatory authority of a permit, or equivalent permission, to begin construction. Numbers reflect permits issued in a given year, not extant permits.

^c Issuance by regulatory authority of license, or equivalent permission, to conduct testing but not to operate at full power.

^d Issuance by regulatory authority of full-power operating license, or equivalent permission. Units generally did not begin immediate operation. See Note 1 at end of section.

^e Ceased operating permanently, irrespective of intent.

^f Total of units holding full-power licenses, or equivalent permission to operate, at the end of the period. See Note 1 at end of section.

^g Cancellation by utilities of ordered units. Does not include three units (Bellefonte 1 and 2 and Watts Bar 2) where construction has been stopped indefinitely.

^h Includes Browns Ferry 1, which was shut down in 1985. The unit is defueled but is still fully licensed. In May 2002, the Tennessee Valley Authority announced its intention to have the unit resume operation in 2007. See Note 1(a) at end of section.

Note: This table covers all units that contributed power to the commercial grid whether or not they were owned by an electric utility. See Note 1 at end of section for additional information.

Web Page: <http://www.eia.doe.gov/emeu/mer/nuclear.html>.

Sources: See end of section.

Nuclear Energy

Note 1. In 1997 EIA undertook a major revision of the data categories in Table 8.2 to make them more relevant to current conditions and trends in the U.S. commercial nuclear electric power industry. To acquire the data for the revised categories it was necessary to develop a reactor unit database employing different sources than those used previously for Table 8.2 and still used for Table 8.1. Because of differences in definitions and tally protocols, the year-by-year tallies of operable reactors in the two databases diverge in some years, although this divergence does not change the overall trends.

The data in Table 8.2 apply to commercial nuclear power units, which means that the units contributed power to the commercial electricity grid whether or not they were owned by an electric utility. A total of 259 units ever ordered was identified. (Many of the orders were placed before 1973 and thus do not appear in the table. Annual data on orders and other characteristics from 1953 forward can be found in EIA's *Annual Energy Review 2000*, Tables 9.1 and 9.2.) Although most orders were placed by electric utilities, several units are or were ordered, owned, and operated wholly or in part by the Federal government, including BONUS (Boiling Nuclear Superheater Power Station), Elk River, Experimental Breeder Reactor 2, Hallam, Hanford N, Piqua, and Shippingport.

A reactor is generally defined as operable in Table 8.2 while it possessed a full-power license from the Nuclear Regulatory Commission or its predecessor the Atomic Energy Commission, or equivalent permission to operate, at the end of the year or month shown. The definition is liberal in that it does not exclude units retaining full-power licenses during long, non-routine shutdowns that for a time rendered them unable to generate electricity. Examples are:

(a) In 1985 the five then-active Tennessee Valley Authority (TVA) units (Browns Ferry 1, 2, and 3 and Sequoyah 1 and 2) were shut down under a regulatory forced outage. Browns Ferry 1 remains shut down and has been defueled, while the other units were idle for several years, restarting in 1991, 1995, 1988, and 1988, respectively. All five units are counted as operable during the shutdowns. Browns Ferry 1 is the only one of the five TVA plants that has not returned to service. Because it is still fully licensed to operate, it continues to meet the definition of operable.

(b) Shippingport was shut down from 1974 through 1976 for conversion to a light-water breeder reactor, but is counted as operable from 1957 until its retirement in 1982.

(c) Calvert Cliffs 2 was shut down in 1989 and 1990 for replacement of pressurizer heater sleeves but is counted as operable during those years.

Exceptions to the definition are Shoreham and Three Mile Island 2. Shoreham was granted a full-power license in April 1989, but was shut down two months later and never

restarted. In 1991, the license was changed to Possession Only. Although not operable at the end of the year, Shoreham is treated as operable during 1989 and shut down in 1990, because counting it as operable and shut down in the same year would introduce a statistical discrepancy in the tallies. A major accident closed Three Mile Island 2 in 1979, and although the unit retained its full-power license for several years, it is considered permanently shut down since that year.

Note 2. Capacity: Nuclear generating units may have more than one type of net capacity rating, including the following:

(a) Net Summer Capability—The steady hourly output that generating equipment is expected to supply to system load, exclusive of auxiliary power, as demonstrated by test at the time of summer peak demand. Auxiliary power of a typical nuclear power plant is about 5 percent of gross generation.

(b) Net Design Capacity or Net Design Electrical Rating (DER)—The nominal net electrical output of a unit, specified by the utility and used for plant design.

The monthly capacity factors are computed as the actual monthly generation divided by the maximum possible generation for that month. The maximum possible generation is the number of hours in the month multiplied by the net summer capability at the end of the month. That fraction is then multiplied by 100 to obtain a percentage. Annual capacity factors are averages of the monthly values for that year.

Table 8.1 Sources

Nuclear Electricity Net Generation and Nuclear Share of Electricity Net Generation: See Table 7.2 for actual data. The forecast value is derived from EIA's Short-Term Integrated Forecasting System. See related note on page 79 (Note 9).

Net Summer Capability of Operable Units: 1973-1982: Compiled from various sources, primarily DOE, Office of Nuclear Reactor Programs, "U.S. Central Station Nuclear Electric Generating Units: Significant Milestones."

1983 forward: Energy Information Administration (EIA), Form EIA-860, "Annual Electric Generator Report," and monthly updates as appropriate.

Capacity Factor: EIA, Office of Coal, Nuclear, Electric and Alternate Fuels for actual data. The forecast value is derived from EIA's Short-Term Integrated Forecasting System. See related note on page 79 (Note 9).

Table 8.2 Sources

Orders: Energy Information Administration, *Commercial Nuclear Power 1991*, Appendix E, September 1991; Nuclear Energy Institute, *Historical Profile of U.S. Nuclear Power Development*, 1988 edition; U.S. Atomic Energy Commission, *1973 Annual Report to Congress, Volume 2, Regulatory Activities*; various utilities.

Construction Permits: Nuclear Regulatory Commission, *Information Digest*, 1997 edition, Appendix A; Nuclear Energy Institute, *Historical Profile of U.S. Nuclear Power Development*, 1988 edition; various utility, Federal, and contractor officials.

Low-Power Operating Licenses: Nuclear Energy Institute, *Historical Profile of U.S. Nuclear Power Development*, 1988 edition; U.S. Department of Energy, *Nuclear Reactors Built, Being Built, and Planned: 1995*; various utility, Federal, and contractor officials.

New Operable Units: Nuclear Regulatory Commission, *Information Digest*, 1997 edition, Table 11 and Appendices A and B; various utility, Federal, and contractor officials.

Shutdowns: Energy Information Administration, *Commercial Nuclear Power 1991*, Appendix E; Nuclear

Regulatory Commission, *Information Digest*, 1997 edition, Appendix B; U.S. Department of Energy, *Nuclear Reactors Built, Being Built, and Planned: 1995*; Tennessee Valley Authority officials; various Nuclear Regulatory Commission documents.

Total Operable Units: Commercial reactors fully licensed to operate, excluding permanent shutdowns.

Cancellations: Energy Information Administration, *Commercial Nuclear Power 1991*, Appendix E, September 1991; Nuclear Regulatory Commission, *Information Digest*, 1997 edition, Appendix C; and Nuclear Energy Institute, *Historical Profile of U.S. Nuclear Power Development*, 1988 edition.